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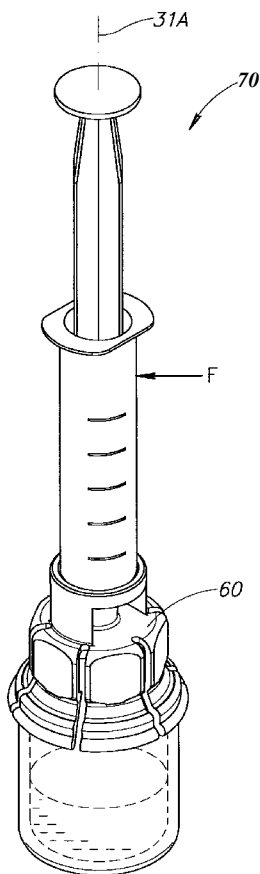
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(54) Title: VIAL ADAPTER WITH SYRINGE STABILIZER

(57) Abstract: Vial adapters for use with a needleless syringe having a syringe barrel with a distal barrel end and a male connector, and a vial. The vial adapters include a vial adapter body including a female connector for sealing engagement with a syringe's male connector on sliding insertion therein. The vial adapters include a syringe stabilizer integrally formed on a vial adapter body and having a support ring for snugly receiving a distal barrel end on the sliding insertion of a male connector into the female connector for sealing engagement such that the syringe stabilizer precludes inadvertent snapping off of the male connector from the distal barrel end on application of a force on the syringe barrel in a transverse direction to the longitudinal vial adapter axis.



I  
FIG. 7



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## VIAL ADAPTER WITH SYRINGE STABILIZER

### Field of the Invention

This invention relates to vial adapters.

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### Background of the Invention

Vial adapters are commonly employed with a needleless syringe and a vial for liquid drug reconstitution and administration purposes. Needleless syringes include a syringe barrel terminating at a male connector and a plunger for reciprocal movement within the syringe barrel. Syringes pre-filled with diluent for liquid drug reconstitution purposes are typically formed from glass. Glass syringes are therefore fragile and their male connectors are particularly prone to be inadvertently snapped off. Some syringes have a so-called locking collar encircling a male connector for screw thread engagement on a threaded female connector. Vial adapters include a vial adapter body with a downward depending skirt for telescopically snap fitting onto a vial, a downward depending hollow cannula for insertion into a vial's interior, and a female connector in flow communication with the cannula for sealingly receiving a syringe's male connector. The male and female connectors are conic shaped for assisting insertion of a male connector into a female connector until the former stops in the latter in a coaxial sealed arrangement. The male and female connectors can be Luer connectors.

A user typically snap fits a vial adapter onto a vial before attaching a syringe for liquid drug reconstitution and administration purposes. The user holds the assemblage of a vial adapter and a vial in one hand and a syringe in his other hand and aligns the syringe with the longitudinal vial adapter axis prior to insertion of the syringe's male connector into the vial adapter's female connector. The user maintains his hold on the assemblage and continues to insert the syringe's male connector into the vial adapter's female connector in a generally co-axial forward movement until the syringe stops in the vial adapter in their intended coaxial sealed engagement.

During the generally coaxial forward movement, a user may inadvertently apply a force on the syringe barrel in a transverse direction to the longitudinal vial adapter axis which may be sufficient to snap off the male connector at its base from the distal barrel end. Such snapping off leaves  
5 exposed jagged rims at the distal barrel end and also at the male connector inserted in the female connector which pose immediate risks to the user and also during subsequent disposal. Additionally, in the case of syringes without a locking collar, a user may inadvertently apply such a force during the aforesaid coaxial sealed arrangement with the same undesired result.

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### **Summary of the Invention**

The present invention is directed towards vial adapters for use with a needleless syringe having a syringe barrel with a distal barrel end and a male connector, and a vial. The vial adapters include a vial adapter body having a  
15 female connector for sealing engagement with a syringe's male connector on sliding insertion therein. The vial adapters include a syringe stabilizer integrally formed on a vial adapter body and having a support ring for snugly receiving a distal barrel end on the sliding insertion of a male connector into the female connector for sealing engagement such that the syringe stabilizer  
20 precludes inadvertent snapping off of the male connector from the distal barrel end on application of a force on the syringe barrel in a transverse direction to the longitudinal vial adapter axis. Both non-vented and vented vial adapters can be equally integrally formed with a syringe stabilizer in accordance with the present invention.

25

### **Brief Description of Drawings**

In order to understand the invention and to see how it can be carried out in practice, a preferred embodiment will now be described, by way of a non-limiting example only, with reference to the accompanying drawings in which  
30 similar parts are likewise numbered, and in which:

Fig. 1 is a pictorial view of a conventional vial adapter having a longitudinal vial adapter axis, a syringe and a vial;

Fig. 2A is a bottom perspective view of Figure 1's vial adapter;

Fig. 2B is a longitudinal cross section of Figure 1's vial along line A-A  
5 therein;

Fig. 3 is a front perspective view of an assemblage of Figure 1's vial adapter, syringe and vial;

Fig. 4 is pictorial view of Figure 3's assemblage subsequent to snapping off of the syringe's male connector pursuant to application of a force on the  
10 syringe barrel in a transverse direction to the longitudinal vial adapter axis;

Fig. 5 is a front perspective view of a vial adapter with an integrally formed syringe stabilizer in accordance with the present invention;

Fig. 6 is a cross section of Figure 5's vial adapter along line B-B therein;

Fig. 7 is a front perspective view showing an assemblage of Figure 5's  
15 vial adapter, a syringe and a vial in their intended coaxial sealed engagement;  
and

Fig. 8 is a front elevation view of Figure 7's assemblage.

### Detailed Description of Preferred Embodiment of the Invention

20 Figure 1 shows a syringe 10 constituting a source of physiological fluid, a vial 20 constituting a medicinal vessel and a conventional vial adapter 30 for use with the syringe 10 and the vial 20. The syringe 10 includes a syringe barrel 11 having a distal barrel end 11A, a plunger 12 and a male connector 13. The distal barrel end 11A has an external diameter  $D_1$ . The vial 20 has a  
25 longitudinal vial axis 20A and includes a vial body 21 with a vial rim 22 and a narrow diameter neck 23 intermediate the vial body 21 and the vial rim 22 (see Figure 2B). The vial rim 22 defines a vial opening 24 hermetically sealed by an elastic vial stopper 26, and capped by a metal band 27. The vial body 21 defines a vial interior 28 containing either a powdered or liquid drug contents  
30 29. The syringe 10 typically contains diluents for reconstituting the vial contents 29.

Figures 1 and 2A show the vial adapter 30 has a vial adapter body 31 having a longitudinal vial adapter axis 31A and including a top wall 32, a downward depending flared skirt 33 with a multitude of flex members 34 for snap fitting onto the vial 20, a pointed tubular cannula 36 with a cannula tip 37  
5 for puncturing the vial stopper 26, and a flow communication lumen 38 in flow communication with the cannula 36. The flow communication lumen 38 terminates in a female connector 39 for sealing engagement with the syringe's male connector 13 on sliding insertion therein. The flex members 34 have a first portion 34A proximate the top wall 32 including an inwardly directed  
10 protuberance 41 for snap fitting under the vial rim 22 and a second portion 34B distal the top wall 32. The second portions 34B subtend an exterior obtuse angle relative to their first portions 34A. The female connector 39 is preferably formed with an external thread 42 for use with a syringe 10 with a locking collar having an internal thread for screw thread engagement thereon.

Figure 3 shows an assemblage 50 of the syringe 10, the vial 20 and the vial adapter 30 after the vial adapter 30 has been snap fitted onto the vial 20 for flow communication with its vial interior 28 and the syringe's male connector 13 has been slidingly inserted into the vial adapter's female connector 39 for sealed engagement therewith. Figure 3 shows application of a force F against  
20 the syringe barrel 11 in a transverse direction to the longitudinal vial adapter axis 31A leads to the snapping off of the male connector 13 from the distal barrel end 11A. Figure 4 shows the syringe 10 having a leading jagged rim 14 at the base of its male connector 13 connected to the distal barrel end 11A. Figure 4 also shows the male connector 13 remaining in the female connector  
25 39 also has an exposed jagged rim 16. The jagged rims 14 and 16 pose an immediate risk to the user and also during subsequent disposal.

Figures 5 and 6 show a vial adapter 60 having a similar construction as the vial adapter 30 and therefore similar parts are likewise numbered and also suitable for use with syringes with or without a locking collar. The vial adapter  
30 60 differs from the vial adapter 30 insofar the former includes an integrally formed syringe stabilizer 61 having a support ring 62 supported by a pair of

opposite support struts 63 mounted on the top wall 32. The support ring 62 has an internal diameter D2 which is slightly larger than the distal barrel end 11A's external diameter D1. The support ring 62 is disposed distal to the female connector 39 relative to the top wall 32 for snugly receiving a distal barrel end 11A on sliding insertion of a male connector 13 into its female connector 39 for sealed engagement therewith. Thus, the support ring 62, on the one hand, enables sliding insertion of a distal barrel end 11A therethrough, and, on the other hand, acts as a support against an inadvertent application of the force F in a transverse direction to the longitudinal vial adapter axis 31A.

Figures 7 and 8 show an assemblage 70 including the vial adapter 60 for precluding an inadvertent application of the force F in a transverse direction to the longitudinal vial adapter axis 31A snapping off of the male connector 13.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications, and other applications of the invention can be made within the scope of the appended claims.

**CLAIMS:**

1. A vial adapter for use with a syringe and a vial, the syringe including a barrel having a distal barrel end and a male connector, the vial having a vial interior for containing vial contents, the vial adapter having a longitudinal vial adapter axis and comprising:
- 5
- a) a vial adapter body including a top wall transverse to said longitudinal vial adapter axis, a downward depending skirt with flex members for snap fitting onto the vial for concentric mounting said vial adapter body on the vial,
- 10 a downward depending pointed tubular cannula for establishing flow communication with the vial interior on said snap fit mounting, an upright tubular female connector mounted on said top wall opposite said cannula and in flow communication therewith for sealing engagement with the male connector; and
- 15 b) a syringe stabilizer integrally formed on said vial adapter body, said syringe stabilizer including a support ring disposed distal to said female connector relative to said top wall and being sized and shaped for snugly receiving the distal barrel end on said sliding insertion of the male connector into said female connector for said sealing engagement therebetween such that
- 20 said syringe stabilizer precludes inadvertent snapping off of the male connector from the distal barrel end on application of a force on the syringe barrel in a transverse direction to said longitudinal vial adapter axis.
2. The adapter according to claim 1 wherein said syringe stabilizer
- 25 includes at least two spaced apart upright support struts mounted on said top wall for supporting said support ring.



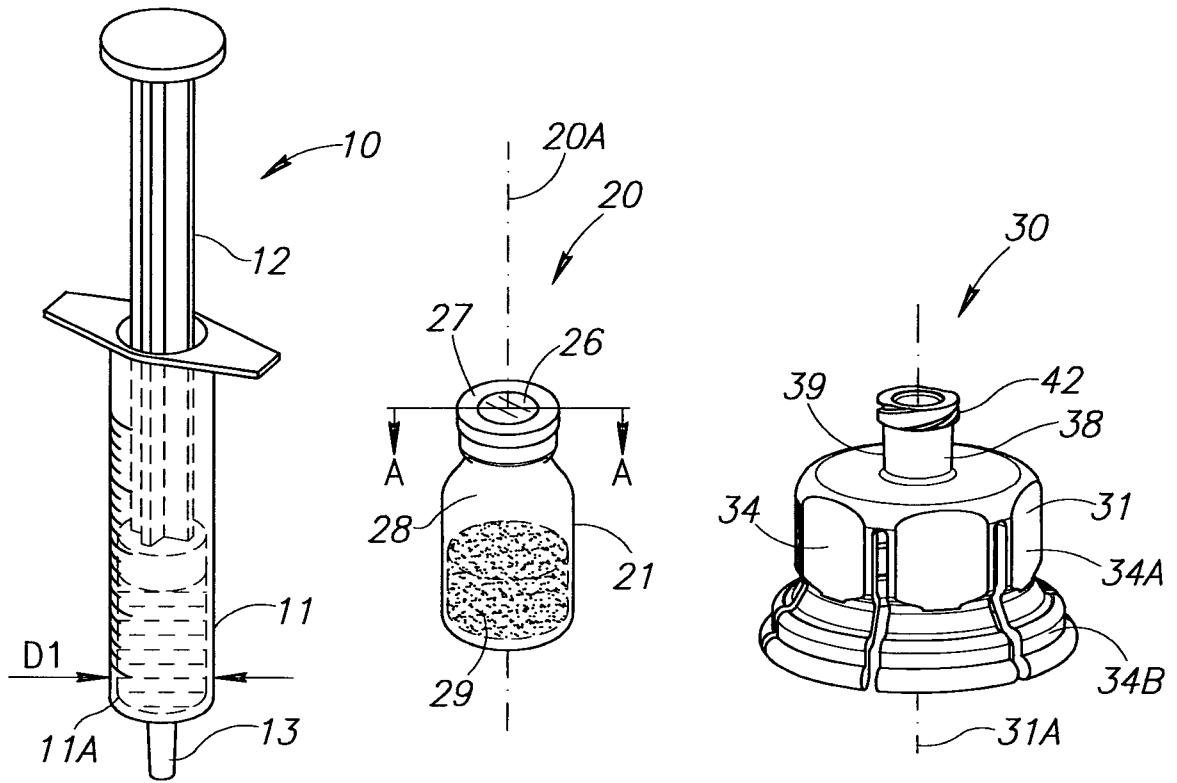


FIG. 1  
(PRIOR ART)

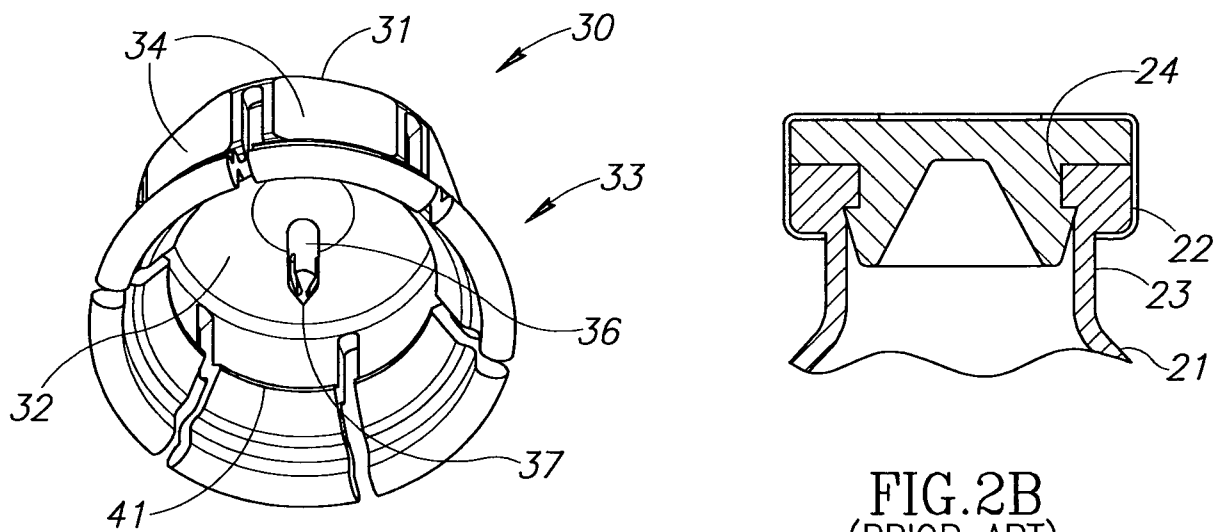


FIG. 2A  
(PRIOR ART)

FIG. 2B  
(PRIOR ART)

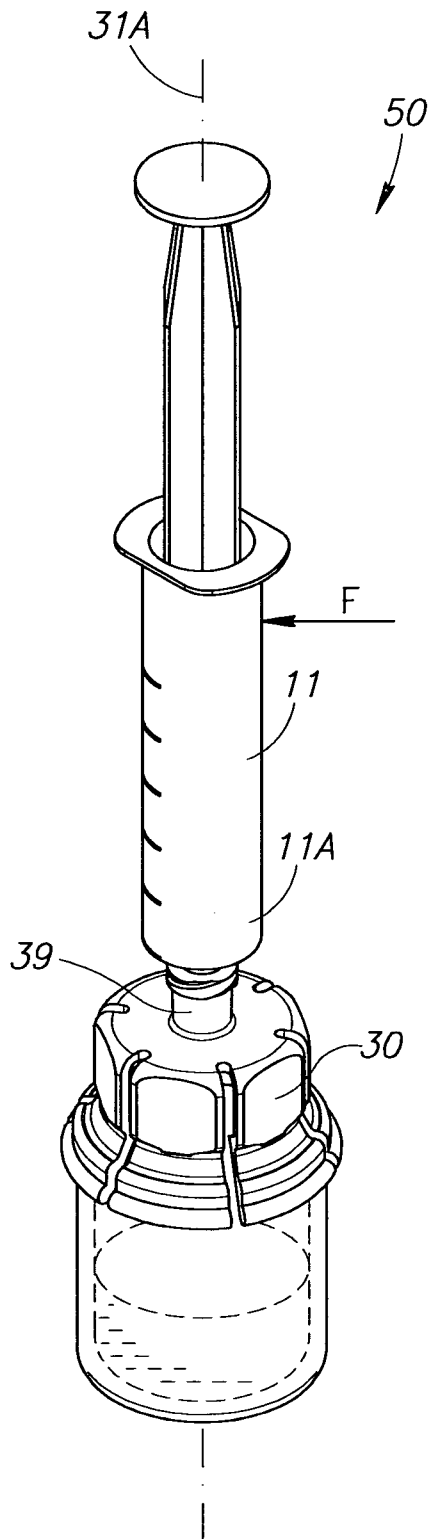


FIG. 3  
(PRIOR ART)

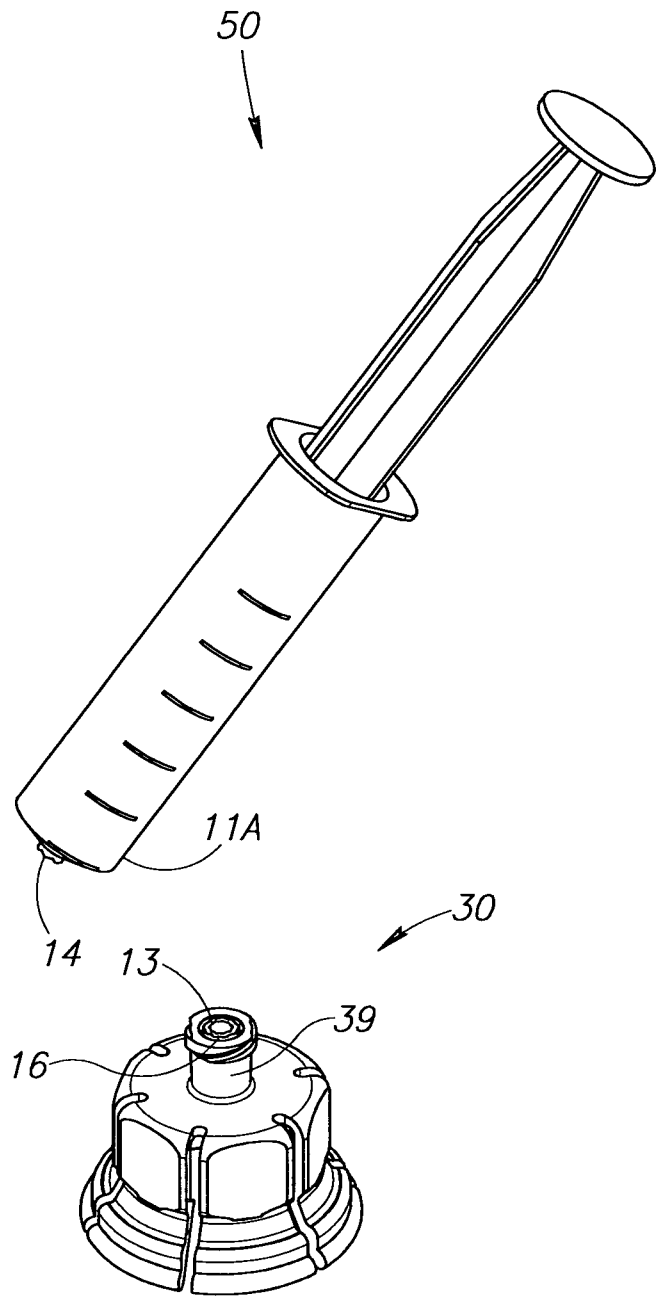


FIG. 4  
(PRIOR ART)

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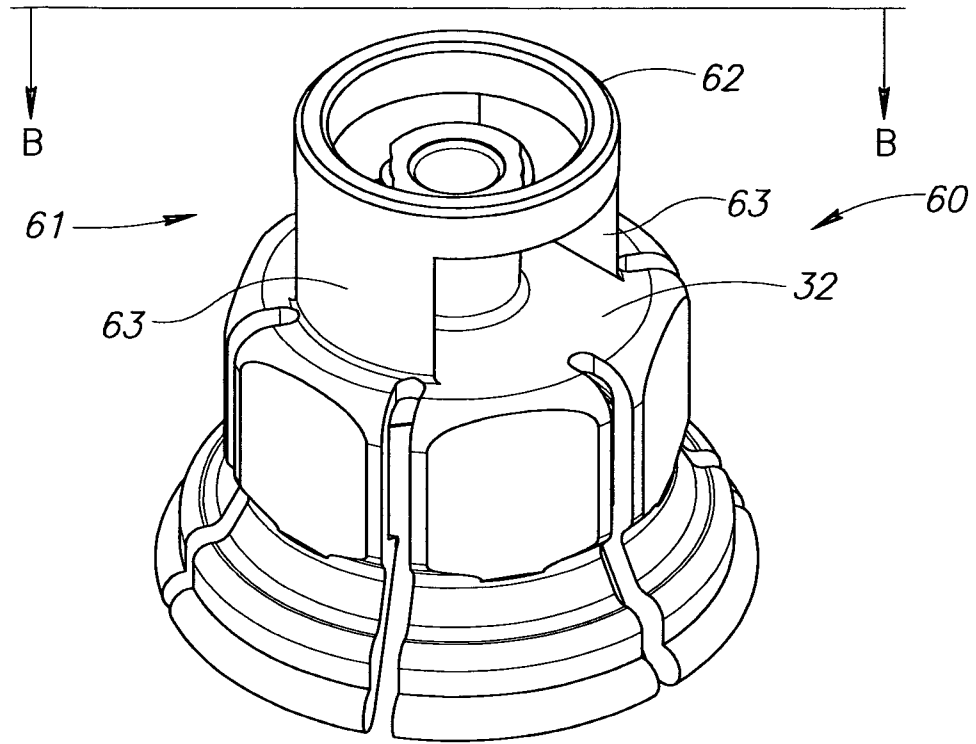


FIG. 5

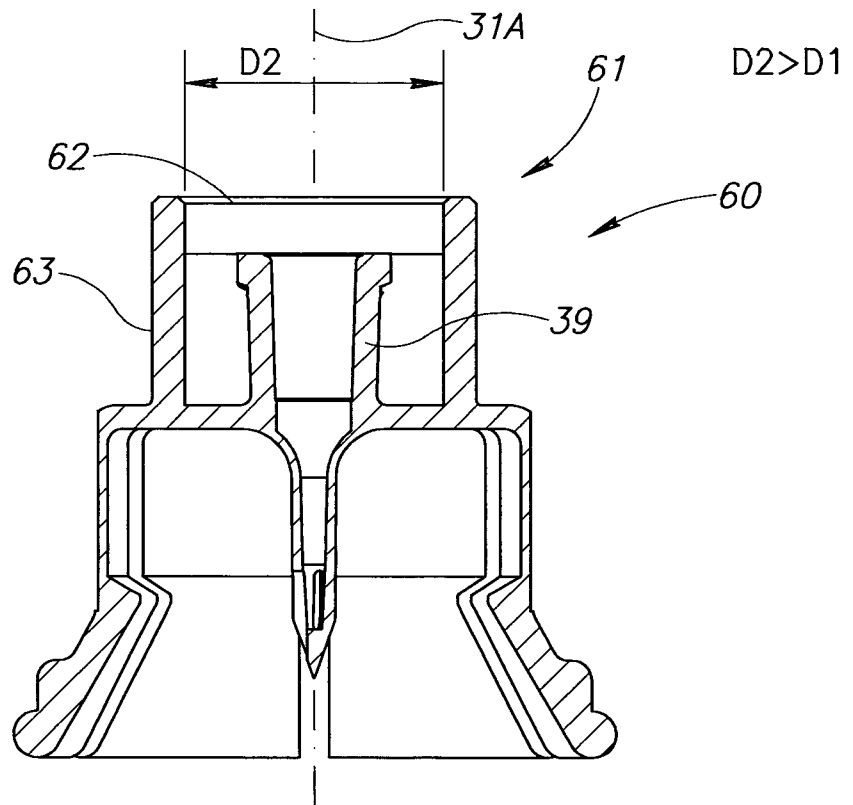


FIG. 6

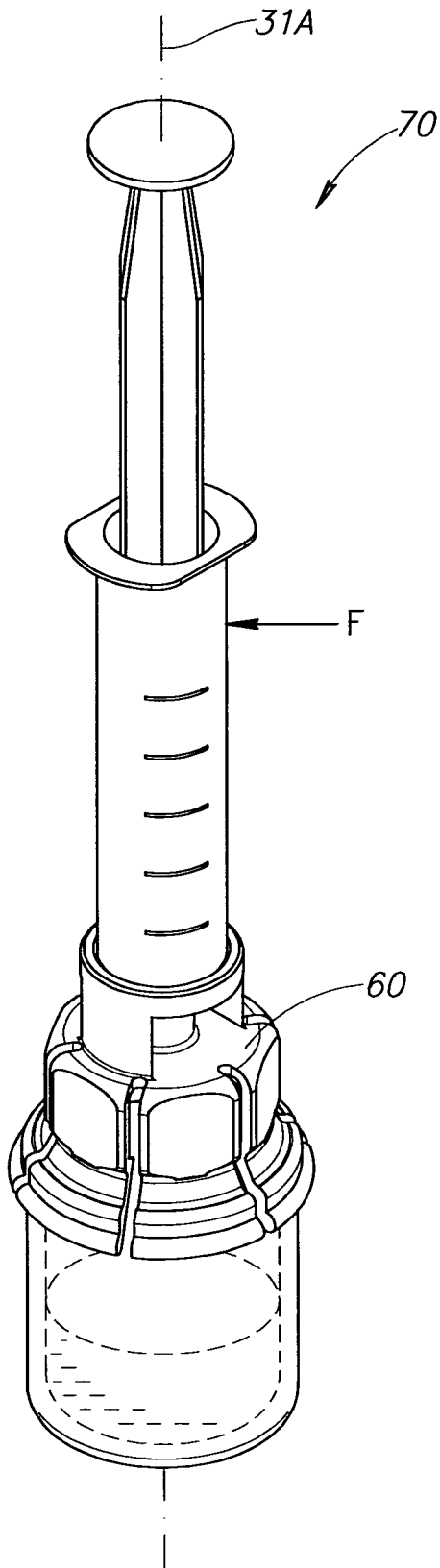


FIG. 7

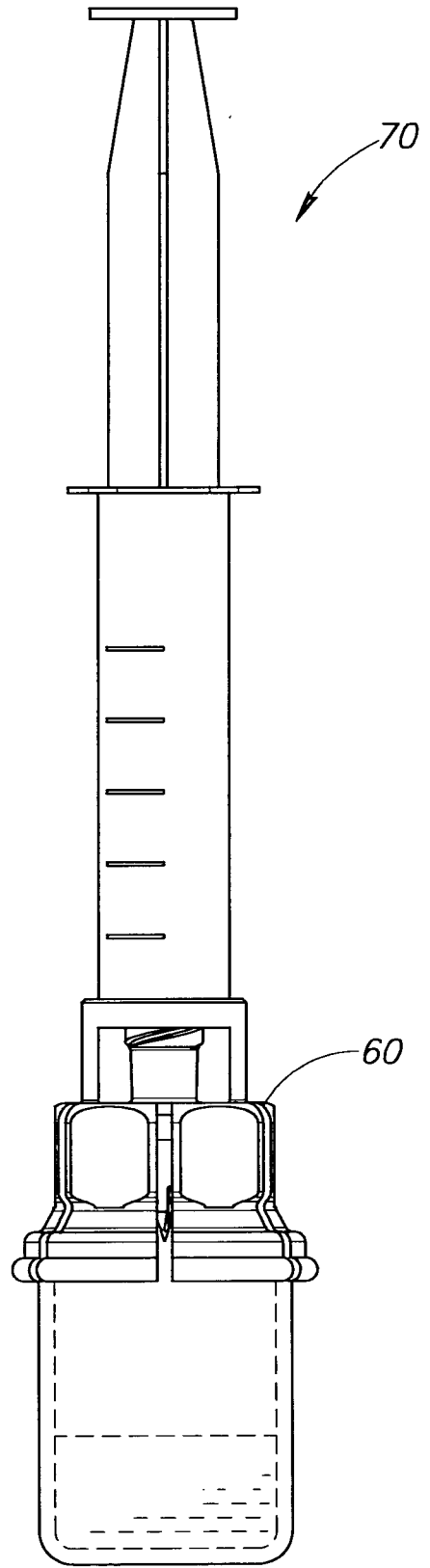


FIG. 8

# INTERNATIONAL SEARCH REPORT

International application No <b>PCT/IL2011/000511</b>
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A. CLASSIFICATION OF SUBJECT MATTER  
**INV. A61J1/20**  
**ADD.**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
**A61J**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
**EPO-Internal**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	wo 2009/026443 A2 (GI LERO LLC [US]; FOSHEE DAVID A [US]; MOSLER THEODORE J [US]; PETERS B) 26 February 2009 (2009-02-26)	1
Y	page 15, line 19 - line 26 page 19, line 6 - line 25 figures 1, 26-27A	2
Y	----- EP 1 930 038 A2 (BECTON DICKINSON CO [US]) 11 June 2008 (2008-06-11) paragraph [0064] figures 2, 3, 4 -----	2

Further documents are listed in the continuation of Box C.       See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search <b>2 September 2011</b>	Date of mailing of the international search report <b>07/10/2011</b>
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  <b>Ong, Hong Dji en</b>
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2011/000511

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